Global Temperature

From Knutti and Sedlacek, 2012
Global trends are more certain than regional trends.

Natural variability plays a larger role at the regional scale.

Local changes in land use can alter the severity of climate change impacts.
What has Changed?

Scientists often discuss changes in terms of averages, but our environments are managed in terms of timing and extremes.
Observed Regional Temperature

Winter temperatures and overnight low temperatures have increased faster than annual averages.

Weighted averages of nClimDiv divisional data from 8 U.S. Great Lakes States.
Projected Temperature

7.5 to 11°F
4.4 to 6.1°C

Projected Temperature Increase by 2100 in A2 and RCP 8.5

Values from CMIP3 A2 and CMIP5 RCP 8.5 Projections, 3rd National Climate Assessment, 2014. Animation, NASA
More Hot Days Anticipated

Kunkel (2011)
Longer Frost-free Season

From the 3rd National Climate Assessment, 2014

Projected Great Lakes frost-free season in 2100: ~1-2 months longer
The Great Lakes are Warming

- Lake Superior is warming twice as fast as nearby air.
- Winter ice cover is decreasing.
- Lake Superior could have little to no open-lake ice cover during a typical winter within the next 30 years.

Average Great Lakes ice coverage declined 71% percent from 1973 to 2010

Wang et al., 2012

Austin and Colman, 2007
Observed Regional Precipitation

Precipitation is variable. Some areas have seen declines while the region overall has seen an increase.

Weighted averages of nClimDiv divisional data from 8 U.S. Great Lakes States.
Observed Extreme Precipitation

The amount falling in the heaviest 1% of precipitation events increased by 37% in the Midwest and by 71% in the Northeast from 1958 to 2012.

Following methodology from Groisman et al, 2005, updated.
Seasonality of Precipitation

- Shorter winters have lead to more precipitation falling as rain instead of snow.
- Warmer surface temperatures have reduced snow accumulation.
- More lake effect precipitation events have increased snowfall in some areas.
Observed Snowfall

Snowfall has increased across the Northern Midwest

Snowfall has decreased in the Southern Midwest
Projected Precipitation

Projected Precipitation Change, A2 Emissions, 2070-2099

Winter
+10 to 30%

Spring
+0 to +30%

Summer
-20 to 0%

Fall
+0 to +30%

NOAA NCDC / CICS-NC
Impacts of Climate Change in the Great Lakes Region

Changes in temperature and precipitation throughout the region will lead to many impacts in both engineered and natural environments.

- Water
- Energy
- Forests
- Agriculture
- Biodiversity
- Public Health
- Transportation
- Fish and Wildlife
- Tourism and Recreation

GLISA
How will we adapt?